PROPOSALS

For Reading by SUBSCRIPTION,

A

Previous COURSE

OF

Mathematics and Natural Philosophy;

Together with an ENTIRE

Subsequent COURSE

OF

ASTRONOMY.

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PROPOSITIONS,

I. TO define Mathematics, and diftinguifh them into their three principal Species, arifing from the three different manners of expreffing Quantity; *viz*, Arithmetic, Algebra, and Geometry, or the doctrine of Surfaces and Solids.

II. To explain the fimpleft and primary of all Mathematical Ideas, *viz.* Points; and proceed to the formation of Lines, crooked or ftrait, of Surfaces, plain or curv'd, convex or concave.

III. To define Angles, and diftinguifh them into their fix Species, *viz.* rectilinear, curvilinear, or mixt, arifing from the refpective Natures of their component Lines; and alfo right, obtufe, or acute, arifing from the refpective directions of the faid lines.

IV. To explain the parts of an Angle, *viz.* its legs or fides, and its vertex or angular point; and to fhow the general method of expreffing and meafuring Angles, and that the refpective quantity of an Angle does not depend upon the length, but upon the width, of its fides.

V. To define plain Figures, and diftinguifh them into Circles, Ellipfes or Ovals, Triangles, Squares, &c.

VI. To explain the formation of a Circle, and the feveral terms, Centre, Circumference, Diameter, Semicircumference, Semidiameter or Radius, Arc, Segment, Chord, and Area.

VII. To explain and prove the feveral effential properties of a Circle, which refult from its formation, *viz.* that every Diameter divides the Circumference or Circle into two equal parts, call'd Semicircumferences or Semicircles; that every ftrait line, drawn from the Centre to any particle of the Circumference is a Radius; that all Radii or Semidiameters, and confequently, all Diameters, are equal.

VIII. To fhow that every Circumference is divifible into Degrees, Minutes, Seconds, Thirds, &c. and the manner in which the faid parts are expreft; to explain more fully the meafurement of Angles, by the fweeping a Circle, whofe Centre fhall coincide with the Vertex of the Angle; and to fhow, that the length of the Diameter of the meafuring Circle, has no more effect upon the quantity of the intercepted Arc, than the length of the legs has upon the quantity of the contain'd Angle. *Vid.* Prop. IV.

IX. To defcribe the Protractor, a little Inftrument made in confequence of Prop. the 8th, by which the largeft poffible Arcs, and Angles, even thofe in the ftarry Heaven, may be meafur'd; and Angles of any given magnitude drawn.

X. To

X. To recite and explain several necessary Axioms, or self-evident Propositions.

XI. To explain the phrase, subtended by Arcs; and show, that Angles, which are subtended by equal Arcs, are equal.

XII. To explain contiguous Angles, and distinguish them as their outermost legs coalesce, or do not coalesce, into a strait line; and to show that in the former case, the total quantity of those contiguous Angles, whatever their number be, is always equal to two right Angles.

XIII. To show, that the four Angles, made by the Intersection of two strait lines, about the point of Intersection; and that any number of Angles, made by the Intersection of any number of lines, about the point of Intersection; are, when taken together, equal to four right Angles.

XIV. To define vertical Angles, and demonstrate,

That vertical Angles are equal.

XV. To define parallel lines, and show their properties; *viz*. that they can never meet; and that a third strait line, crossing them, will have the same inclination to both, or form equal contiguous Angles upon them both.

XVI. To explain the names, external, internal, internal on the same side, alternate, and opposite on the same side; which are respectively given to some of the eight Angles, which are made, by a strait line crossing two parallel lines; and to demonstrate,

That the alternate Angles are equal, and,

That the internal Angles on the same side, taken together, are equal to two right Angles.

XVII. To explain the doctrine of converting Propositions; by which, conclusions in one case, become suppositions in another; and suppositions in one case, conclusions in another.

XVIII. To define Triangles, and distinguish them into their six Species, *viz*. Rectilinear, Curvilinear, and Mixt, arising from the respective natures of their component lines; and also Equilateral, Isosceles, and Scalene, arising from the respective natures of their component Angles: to explain the terms, base and sides, of a Triangle: to demonstrate,

That in every Triangle, the three Angles, taken together, are equal to two right Angles.

And to deduce from thence the following useful Corollaries;

1. When the quantity of one Angle in a Triangle is given, the quantity of the remaining two may be easily known; and when the quantity of two is given, the quantity of the remaining one may be found.

2. If two Angles in one Triangle be equal to two Angles in another Triangle, the remaining Angles of each Triangle will be equal.

3. When a Triangle has one Angle right, the other two must be acute.

4. If

4. If an acute Angle of one right-angled Triangle, be equal to an acute Angle of another right-angled Triangle, the remaining Angles are also equal, and the two Triangles equiangular.

XIX. To define Trigonometry, and diftinguifh it into plain and fpherical: and to enumerate the principal parts in every Triangle.

XX. To define quadri-lateral or four-fided Figures; and diftinguifh them into Squares, Trapeziums, Rhombus's, Parallelograms rectangled or oblique-angled, and Rhomboids; to explain their feveral denominations, proceeding from their component parts, or particular likeneffes; and to define Diagonals.

XXI. To explain the formation of, and manner of expreffing and meafuring, Squares, Rhombus's, and Parallelograms: and to demonftrate,

~~That all Squares and Rhombus's, which have equal fides, contain equal areas; and~~ that all Parallelograms, which have equal bafes, and equal perpendicular heights, are alfo equal.

XXII. To compare three-fided and four-fided figures together, and demonftrate,

That the area of every Triangle is equal, to half the area of a Square or Parallelogram, which has equal bafe and perpendicular altitude.

XXIII. To define Polygons, and diftinguifh them into regular and irregular; and the regular into Pentagons, Hexagons, Heptagons, Octagons, &c. to fhow the method of finding their areas; and to explain the Theory of furveying land.

XXIV. To fhow how the area of a Circle may be found; and to what exactnefs it is poffible, or not poffible, to fquare the Circle.

XXV. Previous to the doctrine of Ratio's or Proportion, to diftinguifh numbers into planes or products, fquares or fuperficial, and cubes or folid numbers; to explain the terms, factors or fides of a Rectangle, Square-root or fide of a Square, and Cube-root or fide of a folid number; to teach the method of extracting the roots; to point out the analogy between Arithmetic and Geometry, and to fhow, that each of thefe is equally expreffive of every kind of quantity.

XXVI. To define the aliquot or aliquant parts of quantity, commenfurable or rational, and incommenfurable, irrational, or furd quantities.

XXVII. To explain proportion, and diftinguifh it into proportion between two proportional terms, and proportion between four proportionals.

XXVIII. In proportion between two terms, to explain the antecedent and confequent; the terms which are us'd when the antecedent or confequent are aliquot or aliquant parts of each other, the Ratio's of inequality or equality thence arifing, viz. in Ratio's of majority in the Antecedent, Duple, Triple, Quadruple, &c. or Sefquialtera, Sefquitertia, Sefquiquarta, &c; and in Ratio's of minority in the antecedent, Subduple, Subtriple, Subquadruple, &c; or Subfefquialtera, Subfefquitertia, Subfefquiquarta, &c.

XXIX. In

XXIX. In proportion between four terms, to explain the manner of expreſ-
ſing them, and the mean proportional; to diſtinguiſh them into direct
and reciprocal; and to illuſtrate the whole by apt inſtances, bor-
row'd from the material or mechanical world.

XXX. To explain the powers of quantity, and diſtinguiſh them into the firſt
power or root, the ſecond power or ſquare, the third power or cube,
the fourth power or quadrato-quadrate, &c. to explain the phraſe
Æqui poſſe or equal in power; to compare powers, and explain the
direct or reciprocal proportions thence reſulting, viz. duplicate, tri-
plicate, ſeſquiplicate, &c. and to illuſtrate them by fit examples.

XXXI. To define ſimilar, or like plain figures; to ſhow that all circles are
ſimilar; and the method of obſerving the ſimilarity of Quadrilaterals
and Triangles; to prove,
That all Equiangular Triangles are ſimilar; and to demonſtrate,
That if in a Triangle, a line be drawn from one ſide to the other,
parallel to the Baſe, the ſaid line will cut the ſides proportionally;
and there will be form'd a new Triangle, ſimilar to the former.

XXXII. To explain the terms Hypothenuſe and Legs; and demonſtrate,
That in every Right-angled Triangle, the Hypothenuſe is equal
in power to the two Legs.

XXXIII. To explain the terms, Complement, Supplement, Chord or Sub-
tenſe, Right-Sine or Sine, Verſed-Sine or Sagitta, Tangent, Secant,
Coſine, Cotangent, Coſecant of an Arc; and to obſerve the following
properties and analogies of them;
1. As every Chord divides the Circle into two parts and belongs
to both, tho' ever ſo unequal; ſo likewiſe every Sine is Sine to both
Arcs of a Semicircle, tho' ever ſo unequal; and likewiſe Tangents
and Secants belong, not only to the Arc, but alſo to the Supplement
of that Arc.
2. As Chords increaſe with the Arc of a Circle till it becomes a
Semicircle, and has for its Chord a Diameter, and afterwards decreaſe,
notwithſtanding the increaſe of the Arc, yea decreaſe the more, the
more the Arc increaſes; ſo likewiſe Sines, Tangents and Secants have
the ſame relation to the Arcs of a Semicircle; and by this means
have prevented great toil in their computation, ſince they need not
be computed for above 90°, and neverthelefs ſerve for any Angle
under 180°.
3. Verſed Sines need not be computed, becauſe eaſily knowable
from the Coſine and Radius.

XXXIV. To explain the meaſurement, and expreſſion, of Sines, Tangents,
and Secants; to exhibit a ſpecimen of two ſorts of tables,
viz. Vlacq's and Sherwin's; and to ſhow the uſe of them, both in di-
rect and converted caſes.

XXXV. To ſhow, the ſeveral ſteps taken by learned and induſtrious men, to
conſtruct theſe tables, and
1ª. To diſtinguiſh Sines into primary and ſecondary; to ſhow the
manner

manner of difcovering the primary, and the clofe connection between the primary and fecondary ; and to demonftrate,

That the Radius of a Circle is equal to the fide of a Hexagon infcrib'd within the faid Circle.

2dly. To fhow the dependency of Cofines upon Sines, and demonftrate,

That the Sine and Cofine of any Arc, are equal in power to the Radius.

3dly. To fhow how Chords are deducible from right and verfed Sines ; and demonftrate,

That the Sine and Sagitta, are equal in power to the Chord of the fame Arc.

4^{thly}. To fhow the connexion between Sines and Chords, and demonftrate,

That the Sine of one Arc is equal to half the Chord of another double Arc.

5^{thly}. To fhow the dependency of Secants and Tangents upon the already difcover'd parts.

XXXVI. To explain, prove, or demonftrate the following Trigonometrical Truths,

1. In every Right-Angled Triangle the fides are, either Radius, Sine, and Cofine of one of the Acute Angles; or Radius, Tangent, and Secant of the other.

2. In a Right-Angled Triangle, one of the fides may be made Radius, and then each of the other will be Sine, Tangent, or Secant of the Acute Angles.

Cafe 1. If the Hypothenufe be made Radius, the Legs fhall be Sines of the oppofite Angles.

Cafe 2. If one of the legs be made Radius, the other fhall be Tangent to the oppofite Angle, and the Hypothenufe Secant of the fame.

3. By confequence, when all the Angles of a Right-Angled Triangle are given, the proportion between any two of its fides may be found ; and if the real meafure of one be given, the real meafure of the other may be found, by the Golden Rule.

4. Univerfally therefore, if in a Right-Angled Triangle one Acute Angle, and one fide be given, the whole Triangle may thence be found ; which truth will be fhown of moft extraordinary fervice, in the meafurement of the heights and diftances of inacceffible objects, both Cæleftial and Terreftrial.

XXXVII. To define Logarithms, or artificial, or rational numbers, another part of the exhibited tables ; and fhow their extraordinary and compendious affiftance in calculation, when Logarithms are fubftituted for natural numbers.

XXXVIII. To compare Lines and Planes together; and fhow when Lines are perpendicular, oblique, or parallel to Planes.

XXXIX. To compare Planes together, and show when Planes are perpendicular, oblique or inclining, or parallel; to explain their common Section, and Angle of Inclination; and show how the latter is to be estimated.

XL. To compare plain figures drawn upon Planes together, and show when these are perpendicular, inclining, or parallel; especially Circles.

XLI. To define Solids, and distinguish them into regular and irregular; and enumerate the principal species of the regular.

XLII. To explain the formation of a Sphere or Globe, and the terms of that Solid, *viz.* Centre, Radius, Diameter, Tangent, greater or lesser Circle; and to show that the terms Sphere and Globe, altho' originally synonimous, are now of distinct significations.

XLIII. To compare Lines, and the concave, or convex surfaces of Spheres together; and show when Lines are perpendicular, oblique, or parallel to such Surfaces.

XLIV. To show the extraordinary usefulness of the Globes in Ouranography and Geography; to give a general prospect of the surfaces of the Heavens and the Earth; and to explain upon the Globes several of *Gordon*'s Problems and Paradoxes.

XLV. To define Spherical Angles and Triangles, and show how they are measur'd.

XLVI. To explain the rotation, or whirling of a Globe; its Axis, Poles, and parallel Circles; to consider the generation of parallel Circles, and show from thence that their magnitude is in direct proportion of the distance, between their Poles and the describent Points.

XLVII. To show that two great Circles, upon the same Sphere, must intersect each other, and that the parts must be equal, or Semicircles.

XLVIII. To compare Planes and Spheres; to consider the Section of Spheres, and the figures and solids thereby produc'd.

XLIX. To compare Points and Planes; and show, when Points are said to be in a Plane produc'd, and when elevated above, or deprest below, it.

L. To explain the formation of a Pyramid, and its terms.

LI. To explain the formation of a Cone and its terms; to distinguish the preceding Solids, into right, and scalenous or oblique; and to show how their acuteness is to be estimated.

LII. To compare Cones, and show their similarity; and that vertical Cones, of parallel Bases, are similar.

LIII. To compare Planes and Cones; consider the Section of Cones, and the figures and solids thereby produced; especially the three figures, in consideration of which consists the science call'd Conic Sections; *viz.* the Parabola, the Ellipsis, and the Hyperbola.

LIV. To explain the formation of a Cylinder and its terms, and distinguish these solids. *Vid.* Prop. 50 and 51.

LV. To compare Planes and Cylinders, &c. *Vid.* Prop. 48.

LVI. To

LVI. To explain the formation of a Cube ; to fhow its meafurement, and the Analogy between Squares and Cubes; whereof the former is the common meafure of Surfaces, and the latter of Solids.

Natural Philofophy.

LVII. To define the fcience, to diftinguifh it into Mechanics, Hydroftatics, Pneumatics, and Optics; and give a brief defcription of each.

Optics.

LVIII. To define Optics, and refolve it into its three principal parts ; *viz.* the fenfation of vifion or feeing ; the caufe of vifion or light ; and the organ of vifion or the eye ; and to defcribe the fenfation and organ.

LIX. To define rays of light, and confider their feveral properties;

1. They are not inftantaneous, but cotemporary in different places, and fucceffive in the fame place.

2. They are direct, refracted, or reflected.

3. They obferve the fame laws of motion with other bodies ; and their Refraction and Reflection is accounted for, upon the common principles of Elafticity and Solidity.

LX. To explain Reflection, and the Angles of Incidence and Reflection; to account for Reflection upon the principles of Mechanics ; and to fhow its univerfal law, *viz.* the Angle of Reflection is always equal to the Angle of Incidence.

LXI. To explain Refraction, and account for it ; to define Mediums, and fhow that their fuperficial, and not their internal, Particles, are the caufes of Refraction; and to fhow the general laws of Refraction, *viz.*

1. Perpendicular rays undergo no Refraction.

2. Oblique rays, paffing out of a thinner medium into a denfer, are refracted *ad perpendiculum*, or towards a perpendicular dropt upon the point of incidence ; and the Angle of Refraction varies, according to the denfity, or attraction, of the medium into which they pafs.

3. Oblique rays, paffing out of a thicker medium into a rarer, are refracted *à perpendiculo*, or from the faid perpendicular ; and this Angle alfo varies according to the rarity, or lefs attraction, of the medium into which they pafs.

LXII. To diftinguifh mediums from their terminating furfaces, into plane, convex, concave, convexo-concave, concavo-convex, and mixt ; to define Lenfes, and diftinguifh them in the fame manner.

LXIII. To apply the laws of Refraction to convex Lenfes, and fhow that parallel Rays are made by them to converge towards a point, from which they afterwards diverge ; and to confider their influence, upon diverging, and converging, rays.

LXIV. To fhow, that a very oblique ray fuffers no Refraction from any medium, but a Reflection ; that all rays are not equally refrangible, which

is the fundamental of the extraordinary Theory of Colours, eſtabliſh'd by the Great Sir, ISAAC NEWTON ; to explain that Theory, and the terms homogeneal and ſimilar ; and to account for the colours of the rainbow, and other colour'd objects.

LXV. To prove that Reflection, and Refraction, do not proceed from the rays impinging upon the ſolid parts of the medium ; but from a power uniformly diffus'd thro' the whole medium, and acting upon the particles before contact, in a direction perpendicular to the ſurface of the medium.

LXVI. To prove the action of the ſides of any body upon the rays ; that parallel rays paſſing on each ſide of a body become convergent, and divergent, when they paſs between two bodies.

LXVII. To define Pencils of rays ; and prove, that every point of a radiant object inceſſantly emits a Hemiſphere of rays, of which a certain conical part is called the Pencil ; and to ſhow how it comes to paſs, that theſe innumerable Hemiſpheres interfere without claſhing.

LXVIII. To ſhow, when an object is diſtant from a Lens ; that all rays falling upon a Lens from a diſtant object are phyſically parallel ; and conſequently that all the Pencils coming from the object will converge, on the focal ſide of the Lens ; and by that means form two baſical Cones, whoſe common Baſe will be the ſection of the Lens, and their vertices, the radiating point on the object ſide ; and the tip of the Pencil on the focal ſide.

LXIX. To prove, that, when an object is ſeen diſtinctly, the tip of every refracted Pencil falls upon the retina ; and conſequently, an image of the object is painted there ; and that this image muſt be inverted, but, nevertheleſs, the object will appear erect.

LXX. To ſhow that the apparent magnitude of any object depends upon the Angle form'd, at the retina, by the axes of the Pencils which proceed from its extreme points ; to explain the optic or viſual Angle and Cone ; to apply this principle, to ſtrait-lines, plain figures, (eſpecially circles) circular planes, globes, &c. and to ſhow what the diſtinct baſe is.

LXXI. To conſider the prominency of objects, eſpecially globes ; to ſhow how we acquire the idea of prominency, ſince the pictures of all objects, upon the retina, are flat ; to account for the prominent appearance of a globe at a moderate diſtance ; and its flatneſs at a large diſtance, eſpecially if it be luminous or uniformly colour'd ; to explain the term diſk, which is given to thoſe circular planes, under which the Sun and Planets appear ; to ſhow that the apparent diameter of the diſk of a Planet, is nearly the ſame, with the apparent diameter of its globe ; and in order to this, to prove, that the nearer any globe is to the eye, the leſs its viſible ſegment is ; and that, when it is very remote, the viſible ſegment will be a phyſical half globe, and the line ſubtending the viſual Angle a phyſical diameter.

LXXII. To

LXXII. To show, that the apparent diameter of a globe is in reciprocal ratio of its distance from the eye ; to convert this proposition, and show that its distance is in reciprocal ratio of its apparent magnitude ; and, upon this principle, to account for the different apparent magnitudes of the same Planet.

LXXIII. To prove that two globes will appear under the same Angle, if their distances be but in direct ratio of their magnitudes ; and that the bigger globe will appear under the smaller Angle, if its distance be greater than this proportion ; to apply this to the Sun and Moon, which, tho' widely different in magnitude, frequently appear under the same Angle ; yea, sometimes the Sun, by far the larger Globe, appears under the smaller Angle ; and hence to account for, the Sun's disk being sometimes quite covered in a central Eclipse, and sometimes surrounded with a little ring of light.

LXXIV. To consider the distance of objects of known magnitude ; and show, that this in an object view'd alone, depends upon the largeness of the Angles it appears under, or the dimensions of its picture upon the retina ; or else the distinctness or confusedness of it ; and that, in objects seen with other objects, it depends further, upon the apparent magnitude, distinctness, or confusedness of these other objects ; and upon the number of them interpos'd.

LXXV. To show why lines or surfaces, really parallel, appear to converge towards a point, of the same height with the spectator's eye ; and to account for, the contraction of regular Vistos ; the descent of strait cielings ; and the ascent of level pavements.

LXXVI. To prove that the eye is no competent judge of distance, but when guided by some of the preceding circumstances ; and hence to account for, the equi-distant appearance of the Sun, Moon, and Stars ; which bodies may be demonstrated to be of distances hugely different.

LXXVII. To prove, that a small removal of the eye, alters not the situation of very remote objects in prospect ; to apply this to the sphere of fixt Stars, and show, that this sphere is so immensely large, that our eye wou'd still seem to be in the centre, and all appearances of the Stars the same, altho' we were to wander, many myriads of miles from our present situation.

LXXVIII. To explain the surprizing Phænomena of the harvest and horizontal Moon ; to give a solution of the former ; to enumerate, explain and refute, the several solutions given of the latter ; to show that it seems to be the barrier of human minds, that it's likely never to be solv'd, and the way, in which, if ever, it must be solv'd.

Perspective.

LXXIX. To define the art, and show wherein its perfection consists, and how it is attainable : to explain its terms, glass, projections, distance ; and distinguish projections into Scenographic, and Orthographic.

LXXX. To

LXXX. To apply Orthographic projection to circles and globes; to show the various aspects of a circle, arising from its various positions; and that a body moving equably in a projected circle or ellipse, will appear to have different velocities in different parts of its orbit; and to apply this to Jupiter's Satellites; which seem to move inequably, and sometimes to swing backwards and forwards before their primary; and also to the solar spots, which moving equably, appear nevertheless to move quicker in the middle, than near the edges, of the disk.

LXXXI. To apply Scenographic projection to circles and globes; to show the several aspects thence arising; and account for several Phænomena conceivable of Mercury.

Astronomy.

LXXXII. To define the science; and exhibit a general prospect of the sphere of the fixt stars; and to account for and show the several constellations visible in the northern Hemisphere; to show how stars are discernible from planets; and account for, the stars appearing less, and the planets sensibly larger, thro' a Telescope.

LXXXIII. To proceed to the solar system, to explain the Ptolemaic, Copernican, and Tychonic system, and establish the true one; to explain the names, characters and natures of every body in this system, to distinguish them into primary, secondary or Satellites, Comets, and the ring of Saturn.

LXXXIV. To prove that our own planet is spherical; and show the nothingness of the highest and greatest mountains, in respect of the whole Globe.

LXXXV. To consider the properties arising from the Spheroidity of the earth; and explain the several circles imagin'd drawn upon its surface; *viz.* the Equator, the Ecliptic, Meridians, Verticals or Azimuths, Colures, Almicantarahs, Parallels, Tropics, and Polar Circles.

LXXXVI. To explain the Horizon, and distinguish it into rational and sensible; and show, that the planes of them continu'd to the Heavens, divide them into two Hemispheres; that they are parallel upon earth, and that the points, in which they intersect the Heavens, coincide; and that every different place on the earth has a different Horizon.

LXXXVII. To explain the Poles of the Horizon, the Zenith and Nadir, and the altitude or depression of a Star; and show how this is to be observ'd by a Quadrant; and to prove, that the altitude is the same when measur'd upon the surface of the earth, as when measur'd at the centre.

LXXXVIII. To prove the rotation of the earth, and show that this accounts for the diurnal motion of the Sun, Moon, Planets, and Stars, as well as the supposition that they actually do move; and to show that their risings and settings proceed from the motion of our Horizon.

LXXXIX. To

LXXXIX. To define days, and diftinguifh them into natural and artificial ; to explain the Poles of the Earth and Heavens, and diftinguifh them into arctic and antarctic ; to explain the Meridians, and fhow, that every Meridian cuts the Horizon at right angles, and marks two cardinal points, or the North and South ; and that a vertical, cutting the Meridian at right angles, marks the other two ; and to explain the Mariner's Compafs, in which are thirty-two points, deriving their names from their relative pofitions to the cardinal points.

XC. To fhow, when it is noon or mid-day, and when mid-night ; that all places lying under the fame Meridian, have their fun-rife, noon, funfet, mid-night, at the fame abfolute time ; that places lying Eaftward, have them fooner than we, and places Weftward later.

XCI. To define Longitude and Latitude, both Celeftial, and Terreftial ; and fhow, from whence, and in what manner, they are computed ; to explain the elevation of the Pole, and fhow how it is obferv'd, and that it is always equal to the Latitude of the place.

XCII. To define hour Circles ; and fhow, the quantity of the Arcs, intercepted between them ; that time is reckon'd from their paffing through the Sun ; and how from an inftantaneous Phænomenon, the Longitude of places may be determined : To explain the art of Dialling ; and fhow how Dials pendent and fixt, univerfal and particular, horizontal, erect, or declining, are calculated and made.

XCIII. To fhow, that, by the Rotation of the Earth, every fuperficial point in the Earth does defcribe, and every point in the Heavens appears to defcribe, the Equator or fome Parallel : To explain the *Maximus femper apparentium, & maximus femper occultorum.*

XCIV. To confider the inhabitants of the Earth, from the Spheres in which they live, and fhow the appearances, to them who live in a right, parallel, or oblique Sphere ; to explain the Zones ; the Antœci, Periœci, Antipodes, Amphifcii, Perifcii, and Heterofcii ; and to fhow their peculiarities, and that the Antipodes have juft the fame reafon to fear our tumbling off the Earth, that we have to fear theirs : and that there is, in fact, no reafon to fear either.

XCV. To define Orbits, to explain the inclination of the Orbits of the Planets, and fhow how they are referr'd to the Orbit of the Earth.

XCVI. To explain the terms Heliocentric and Geocentric, the Heliocentric Orbits, annual Motion, Latitude and Longitude of a Planet ; to explain the afcending and defcending Nodes of a Planet ; and fhow, that it increafes in northern Latitude, till it has got 90° from it afcending Node ; and in fouthern Latitude, till it is 90° from its defcending Node, and appears in the Ecliptic only when it is in one of its Nodes.

XCVII. To explain the Zodiac, fhow the breadth of it, mark the Nodes of each Planet in it, and fhow that the Orbits of the primaries are invariable, and give the characters of the twelve Signs of the Zodiac.

XCVIII.

XCVIII. To fhow, when Conjunctions and Oppofitions are central, and when not; and when a Planet is in Quadrature; to diftinguifh the Planets, into fuperior and inferior, and to explain and account for, the direct, retrograde and ftationary Phænomena, of each fort.

XCIX. To fhow that the inferior Planets can never be in oppofition to the Sun; and that fometimes they will appear like fpots, moving crofs the Solar Difk; to explain and eftimate their elongation; and account for the frequent variations of their apparent diameters: To fhow that the fuperiors are frequently in oppofition; to account for the variation of their apparent diameters; and give the proportion between their greateft and leaft apparent diameters; and to explain the Apogees and Perigees of all Planets; and fhow what occultations are.

C. To fhow that the Planets, Comets, and Saturn's Ring, are rough and opake bodies, deriving all their Light from the Sun; and that rather more than an Hemifphere of them, which is turn'd towards the Sun, is always illuminated: to account for the phafes of the Planets, efpecially thofe of the Moon, viz. New, Crefcent, Half, Gibbous, and Full; and confider the different Phænomena, which would arife from the planetary phafes, to a fpectator in the Moon, and other Planets; and to fhow, that mountains and valleys in the illuminated portions of a Planet, occafion diverfities of brightnefs, and render the edges ragged; why Planets are brighter at one time than another; and that Venus may fometimes be fo bright, as to be vifible in the day-time.

CI. To fhow the manner of drawing Ellipfes, and explain the terms, Periphery, or Circumference, Foci or Umbilici, Axes or Diameters, greater or leffer, and Excentricity.

CII. To prove, that the Orbit of every Planet is an Ellipfe, having the Sun in one of the Foci; and to explain the Line of Apfides, on which the Aphelion, *Aux*, or higher Apfis, and the Perihelion, *oppofitum Augis*, or lower Apfis, lie, and alfo the Line and Place of mean diftance.

CIII. To fhow how the excentricity of Orbits is eftimated, and give the excentricity of the Orbits of the fix primary Planets.

CIV. To compare together, the Perigees and Apogees, the Perihelia and Aphelia; and fhow, how the diftances of the Planets from the Earth, depend upon the refpective coincidence, or diffidence, of thefe points, and that the places of the Aphelia in the primaries are immutable.

CV. To prove, that the Planets move not equally in their Orbits, but obferve this rule; viz. a Line drawn from the Centre of the Sun, to the Centre of the Planet, defcribes equal areas, in equal times, upon the plane of its Orbit; to demonftrate,

That every body, revolving round a Centre, muft obey this law;
To fhow, that the excentricity of each Orbit, depends upon the proportions and directions of the centripetal and centrifugal forces;

and

and to account for the Planets moving, fwifteft in Perihelion, floweft in Aphelion, and meanly at a mean diftance.

CVI. To fhow, that Comets obferve precifely rhe fame laws with the Planets, and are impell'd by the fame forces; and to note the prodigious, and almoft parabolic, excentricity of their Trajectories, the great difference of their directions in them, and of the inclinations of them to each other; and to account for their being vifible only within the Orbit of Jupiter; and that extraordinary Phænomenon of the Tails of the Comets.

CVII. To note and account for the following difference between primaries and fecondaries, that their Aphelia, Perihelia, and Nodes, are mutable.

CVIII. To fhow that the Moon's Nodes, have a flow motion, contrary to the order of Signs, of 19° 22′ each year, which carries them round the Ecliptic, in nineteen years.

CIX. To fhow, the proportion between the diameter of Saturn, and the diameter of his Ring; and its proportional diftance from him; that the plane of this Ring is always parallel to itfelf; to fhow its Nodes and Inclination; the pofitions in which it will be vifible to us, and the fhapes of its appearance; and to explain the belts of a Planet.

CX. To account for the invifibility of the Moon, a day or two before, and after, conjunction; and for that obfcure light, which comes from the unilluminated part of her difk, as foon as fhe becomes vifible; and to explain her Syzygies, Line of Syzygies, abfolute, relative, and mean motion, motion from the Sun; and a periodical, or fynodical, month.

CXI. To define Eclipfes, and diftinguifh them into Solar, Lunar, Secondarial and Stellar; and thefe again into Central, Total, Partial, and Annular.

CXII. To fhow the nature of the Shadows, caft behind each of the Planets from the Sun; that they are of a conical figure, having for their bafis the dark difk, and that the length of them is in direct ratio of the diameters of the Planets, and their diftances from the Sun.

CXIII. To determine the length of the Earth's fhadow, to fhow that it is longer than the Radius of the Moon's Orbit; and that the Moon may be eclipfed by it, when in or near her Nodes: to explain the Penumbra; and the ecliptic fection of the fhadow and Penumbra; to fhow the variations of the dimenfions of the Circle of the Earth's fhadow and Penumbra; to compare the apparent diameter of the Moon and Earth's fhadow together, and fhow that they are nearly in a triple Ratio; to fhow the feveral kinds of Lunar Eclipfes that may happen; to account for the gradual palenefs and obfcurity of the Moon; and to explain the quantity and duration of a Lunar Eclipfe.

CXIV. To fhow how it may be known, whether, at any given Full Moon, there will be an Eclipfe; and if fo, of what kind it will be.

CXV. To fhow that Lunar Eclipfes are vifible to half the Earth at a time; and

and how it may be known upon the Globes, whether any particular Eclipse will be visible to any given place.

CXVI. To solve the following Paradox;

In a Central Eclipse of the Moon, both luminaries shall be really below the Horizon, and yet both shall appear above it.

CXVII. To show, to what parts of the same Hemisphere, a Solar Eclipse will be central, total, partial, or not at all, at the same instant; and upon what, the quantity and duration of a Solar Eclipse, in regard to its several spectators, depend; to explain the projection of the Moon's shadow, its path, and motion, upon the surface of the Earth, and to exhibit Dr. *Halley*'s Map of the Solar Eclipse in 1715.

CXVIII. To explain Parallaxes, and distinguish them into Annual, Diurnal, Menstrual, and Horizontal; and show the influence of some kind of Parallaxes in Eclipses; to account for, the circle of pale Light, which environs the Moon, in a Solar Eclipse; and to explain, and determine, the limits of Solar Eclipses.

CXIX. To show how Solar and Lunar Eclipses would appear, if view'd from other Planets.

CXX. To show, how it may be known, whether at any New Moon there will be an Eclipse; and if so; of what kind it will be; and that general Eclipses of the Sun, tho' not visible in particular climates, must be more frequent than Lunar ones.

CXXI. To explain the motion of the Lunar Syzygies; and show, that the time of the Moon's motion, from one Node to the other, is less than a Semilunation; to apply this to the calculation of Eclipses; and to show that the yearly number of Eclipses, of both luminaries, cannot be, less than two, or more than eight.

CXXII. To explain the restitution of Eclipses, and show that in 18 Y. 11 D. 7 H. 43'. and 5". the Sun, Moon, Lunar Nodes, and Ecliptic Syzygies, revolve to nearly the same point in the Zodiac; and consequently, that in corresponding parts of this periodical time, corresponding Eclipses of the luminaries will fall out; and to explain, the *Saros* of the Chaldæans, by which the number, and almost the time, of the Eclipses that will happen in any particular Year, may be easily known; and also the Golden Number or Cycle of the Moon.

CXXIII. To calculate the Solar and Lunar Eclipses, for the Year 1739, or any other Year, past or to come.

CXXIV. To apply the whole doctrine of Eclipses, to Saturn and Jupiter, and their Satellites or Moons.

CXXV. To show the extraordinary usefulness of Eclipses, in Geography, Astronomy, and Chronology.

CXXVI. To prove, that if the Stars were to be annihilated or obscur'd this very moment, we should continue to see them for several weeks, perhaps years.

CXXVII. To prove that the Horizontal Parallax of any object, equals the Angle, under which the Radius of the Earth would appear, to a

Spectator in that object's place; and to apply this to the distances of the Sun, Comets, and Stars; and to prove that the fixt Stars are immensely distant.

CXXVIII. To distinguish Parallaxes into those of Altitude, Latitude, Longitude, Declination, and right Ascension; and show the remarkable properties and effects of each of these Parallaxes.

CXXIX. To show, that the apparent diameters of the heavenly bodies, are nearly the same to us upon the Surface, as they would be to a Spectator at the Centre, of the Earth.

CXXX. To show how the Sun's apparent diameter may be measur'd.

CXXXI. To observe the extraordinary harmony, between the periods, and distances, of the Planets.

CXXXII. To show, the great probability, of every Planet's being inhabited; and of every Star's being a Sun, plac'd in the Centre of a System of revolving Bodies, which are similar to the Planets and Comets of our System.

CXXXIII. To explain, and account for, the tides; or the flux and reflux of the waters on our Planet.

CONDITIONS.

I. THE preceding Propositions shall be discuss'd in a copious and familiar manner; and in the order in which they now lie, unless Reasons against it should occur.

II. All reasonable Digressions to useful and entertaining Parts of Knowledge, which lie within the Compass of the Lectures, shall readily be made.

III. If any Propositions should be found wanting, they shall be inserted in their proper Places.

IV. The Conceptions of the Audience shall be assisted, by a great Variety of Schemes, and as many Machines as can be procur'd, with tolerable Expence or Labour.

V. And for this, it is expected, that every Subscriber pay

and every occasional

Hearer,   each Night.

Spectator in that object's place; and to apply this to the different of the Sun, Comets, and Stars; and to prove that the fixt Stars are immensely distant.

CXXVIII. To distinguish Parallaxes into those of Altitude, Latitude, Longitude, Declination, and right Ascension; and show the respective properties and effects of each of these Parallaxes.

CXXIX. To show, that the apparent stations of the heavenly bodies, are nearly the same to us regarded to Saturn, as they would be in a spectator at the Centre, of the Earth.

CXXX. To show how the Sun's apparent distance may be measured.

CXXXI. To observe the extraordinary harmony, between the periods, and distances, of the Planets.

CXXXII. To show, the great probability, of every Planet being inhabited; and of every Star, being a Sun, placed in the Centre of a System of revolving Bodies, which are similar to the Planetary and Cometary of our System.

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IV. The Conceptions of the Audience will be assisted, by a great Variety of Schemes, and as many Instruments as can be procur'd, with tolerable Expence of Labour.

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Hourly,   and every annual